

Application No. 10/675,885  
After Final Office Action of December 17, 2007

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Docket No.: 59958(70301)

### REMARKS

In the Office Action dated December 17, 2007, claims 12-24 are pending, claims 16-24 are withdrawn from consideration and claims 12-15 are rejected. Applicants request reconsideration at least for the reasons discussed hereinbelow.

Applicant appreciates the courteous interview extended by Examiner Ewald on April 11, 2008. The substance of the discussion during the interview is included in the remarks below.

The present invention, as recited in claim 12, is directed to a device for the layer-by-layer manufacture of a three-dimensional object by means of selective hardening at those sites of a layer of a building material that correspond to the cross-section of the object through the use of a laser

a focusing unit that focuses the radiation to provide a focused beam;

wherein the laser comprises a switching element for changing the modal composition of the laser radiation which switches the modal composition of the emitted laser radiation between a first setting in which a fundamental Gauss mode is emitted and higher order modes are suppressed and a second setting in which the radiation contains additional higher order modes and the overall power of the radiation is increased.

The prior art fails to teach or suggest at least the claimed switching element.

Claims 12-15 are rejected under 35 U.S.C. §103(a) over Serbin et al. (U.S. 5,753,171: "Serbin") in view of Friesem et al. (U.S. 6,850,544; "Friesem"). Serbin discloses a variable focusing device for changing the area of focus of the laser. As discussed previously, Serbin accomplishes this with a variable focusing device (see FIG. 3). The Examiner admits that Serbin does not "teach the use of a switching element for changing modal composition of the laser radiation which switches the modal composition of the [emitted] laser radiation between a first setting in which a fundamental Gauss mode is emitted and higher order modes are suppressed and a

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second setting in which the radiation contains additional higher modes and the overall power is increased.” Indeed, Serbin merely changes the focal power of the optics.

Friesem is cited to make up for the deficiencies of Serbin. However, Friesem also *fails* to teach or suggest the use of a switching element for changing modal composition of the laser radiation which switches the modal composition of the emitted laser radiation between a first setting in which a fundamental Gauss mode is emitted and higher order modes are suppressed and a second setting in which the radiation contains additional higher modes and the overall power is increased.

Instead, Friesem describes the use of different mode control elements to provide specific modes of radiation. Friesem fails to teach a switching capability. Indeed, Friesem fails to suggest that switching between modes during a process is desirable.

In the terminology of Friesem, the present invention, as set forth in claim 12, works by permanently emitting Gaussian fundamental mode  $TEM_{00}$  and by selectively adding or canceling (by use of the claimed switching element) modes  $TEM_{xy}$  of higher orders. Thus, the laser of the present invention switches between

1.  $TEM_{00}$  and
2.  $TEM_{00} + TEM_{xy}$  (with increased power)

during operation of the device.

In contrast, the mode controlling elements 28, 29 in Friesem are always fixedly mounted in the resonator and cannot be moved or switched during operation. In particular, Friesem describes (at column 13, lines 4-25) integrally formed mode controlling elements 28, 29. Accordingly, it is not possible to switch (by adding or cancelling) higher order modes during operation of the device.

Further, in connection with the description of figures 5-13, Friesem mentions some specific mode control elements such as apertures, cross wires, spiral phase plates (SPP), etc., which are to be incorporated into the resonator. There, Friesem suggests configuring for specific selection

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of modes. However, Friesem never suggests selecting between  $TEM_{00}$  or  $TEM_{00} + TEM_{xy}$ . In other words, Friesem never suggests any combination in which the Gaussian fundamental mode  $TEM_{00}$  is maintained while adding or canceling modes of higher orders.

Thus, neither Serbin nor Friesem, nor their combination teach or suggest that:

- the modal composition of the laser is actually switched during operation of the device; and
- the switching enables a choice between two specific modal compositions of either (i)  $TEM_{00}$  or (ii)  $TEM_{00} + TEM_{xy}$  (with increased power).

The Examiner stated that Friesem described two different modes and it was presumed that there was a switching capability. Applicant respectfully submits that there is no description of switching capability in Friesem, that each mode control element was set to provide a specific mode and that there was no suggestion in Friesem for switching between modes.

The Examiner pointed to the description of FIG. 9 at column 10, lines 37-41 and at column 14, lines 14-21, and to the description of FIG. 21 at column 16, lines 33-42. Applicant respectfully submits that these descriptions with reference to the corresponding figures do not provide any description or suggestion of a switching element as claimed in the present invention, that these citations merely discussed mode control elements and that each were set to provide a specific mode with no switching element.

Further, in support of the lack of suggestion for a switching element, Applicant notes the discussion at column 2, line 65 through column 3, line 20 and the figures, which fail to illustrate any switching element in Friesem.

Thus, it is not seen how the present invention would have been obvious to one of ordinary skill in the art in view of any combination of Serbin and Friesem.

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In view of the discussion above, Applicant respectfully submits that the pending application is in condition for allowance. An early reconsideration and notice of allowance are earnestly solicited.

If for any reason a fee is required, a fee paid is inadequate or credit is owed for any excess fee paid, the Commissioner is hereby authorized and requested to charge Deposit Account No. 04-1105.

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Respectfully submitted,

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